REMARKS

This amendment corrects errors in the text and drawings. Entry is respectfully solicited. This amendment is submitted prior to or concurrently with the payment of the issue fee and, therefore, no petition or fee is required. No new matter has been added.

Respectfully submitted,

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Date: October 9, 2002

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION

Please replace paragraph number **[0003]** with the following:

[0003] However, as shown in drawing FIG. 1, when the resin or underfill material 1 flows to fill the horizontally oriented cavities 3, the flow is usually not uniform due to various design factors of the semiconductor device and lead frame and gravity acting on the resin 1. As a result, the fronts 1a, 1b of the resin 1 flowing above and below the semiconductor device 32 will often meet above the semiconductor device 32 instead of at the vent, causing the molded package to have undesirable air pockets and/or voids 2, as shown in drawing FIG. 2. These types of defects not only degrade the outer appearance of the molded package, but also produce reliability problems with respect to its resistance to thermal shock and exposure to humidity and other contaminants.

Please replace paragraph number **[0029]** with the following:

[0029] A third embodiment of the present invention is illustrated in drawing FIG. 6, depicting resin 24 filling a transfer mold 5″ in a substantially vertical direction to cover at least a portion of the [second] surface 45 of the substrate 42. The third embodiment is similar to the second embodiment in all respects, except the second half 14″ of the transfer mold 5″ includes a plurality of projections 50 configured to extend to the surface 45 of the substrate 42 and contact bond pads 47 thereon. The projections 50 extending from the second half 14″ of the transfer mold 5″ allow resin 24 to rise vertically around the projections 50. Thus, bond pads 47 on the [second] surface 45 of the substrate 42 that are contacted by projections 50 are shielded from resin 24 and are free of resin 24. Therefore, the resin-free bond pads 47 of the substrate 42 can receive solder balls or the like without further significant modification of the layer of resin 24 on surface 45. Moreover, the openings formed in resin 24 may define the configurations of at least the lower portions of solder bumps or other conductive structures formed on bond pads 47.

Please replace paragraph number **[0030]** with the following:

[0030] A fourth embodiment of the present invention is illustrated in drawing FIG. 7, depicting resin 24 filling the cavity 10‴ of a transfer mold 5‴ in a substantially vertical direction to cover at least the [second surface 55] surface 45 of the substrate, in this case a flip-chip type semiconductor die 52. Of course, the cavity 10‴ may alternatively be configured to hold and facilitate encapsulation of an individual semiconductor die 52, a plurality of individual dice, or a wafer or other large-scale substrate with a plurality of semiconductor devices thereon. The fourth embodiment is similar to the second embodiment in all respects, except the semiconductor die 52 includes conductive structures 56, such as balls, bumps, pillars, or columns including a conductive material such as a solder, other metal or metal alloy, a conductive epoxy, a conductor-filled epoxy, or a z-axis conductive elastomer, predisposed on and protruding from the bond pads thereof. Additionally, the second half 14‴ of the transfer mold 5‴ may include a plurality of recesses 58 formed in and configured to receive portions of conductive [structures] bumps 56 so as to prevent resin 24 from completely covering same.

Please replace paragraph number **[0033]** with the following:

[0033] A sixth embodiment is illustrated in drawing FIG's. 9 and 10, depicting resin 24 filling a gap 72 between a semiconductor die 52 and a substrate 64, such as a carrier substrate or an interposer (i.e., a flip-chip assembly 62) in a substantially vertical direction. In the sixth embodiment, at least one barrier 76 is disposed adjacent the periphery 51 of semiconductor die 52 and includes a space or opening 78 formed therein and configured to facilitate dispensing or injecting the resin 24 into a gap 72 between the semiconductor die 52 and the substrate 64. Further, as a dispenser 82 provides resin 24 through opening 78, the resin 24 preferably fills the gap 72 between the substrate 64 and die 52 via capillary action, although positive or negative pressure may be applied to resin 24 as known in the art to accelerate the flow of resin 24 into the gap 72. As such, the at least one barrier 76 is provided to contain the resin in the gap 72 between the semiconductor die 52 and the substrate 64. Accordingly, as in the previous embodiments, it can be well appreciated that gravity provides a more uniform flow front 26, wherein the gravitational force induces the resin 24 to fill in spaces above [solder bumps 66] conductive structures 66 where potential air pockets and/or voids are conventionally formed around the

[solder bumps 66] conductive structures 66 in the gap 72 between the substrate 64 and semiconductor die 52.

IN THE CLAIMS

5. (Amended) The method according to claim 2, wherein said positioning said at least one semiconductor substrate further comprises:
positioning said at least one semiconductor substrate substantially vertically.

6. (Previously amended) The method according to claim [5]4, wherein said introducing said flowable material comprises:
filling said at least one cavity until a single flow front of said flowable material contacts said at least one vent.

10. (Amended) The method according to claim 1, wherein said introducing said flowable material onto said at least one surface of said at least one semiconductor substrate in said substantially vertical direction comprises:
substantially preventing voids in said flowable material.

11. (Amended) The method according to claim 1, wherein said providing said at least one semiconductor substrate comprises:
providing an assembly including said at least one semiconductor substrate.

20. (Amended) The method according to claim 18, wherein said providing said large-scale semiconductor substrate comprises:
providing at least a portion of a wafer.

51. (Amended) A method for encapsulating a substrate that substantially prevents voids in an encapsulant, the method comprising:
providing a transfer mold having an inner surface defining at least one mold cavity;
providing at least one semiconductor substrate having at least one surface with conductive elements thereon and a back surface thereof;
positioning said at least one semiconductor substrate in said at least one mold cavity of said transfer mold so that portions of said inner surface of said transfer mold abut with said

conductive elements of said at least one surface of said at least one semiconductor substrate and another portion of said inner surface abuts with said back surface of said at least one semiconductor substrate; and

introducing a flowable material onto at least one surface of said at least one semiconductor substrate in an upward, non-horizontal direction in said at least one mold cavity so that said flowable material flows around said portions of said inner surface of said transfer mold abutting with said conductive elements on said at least one surface of said at least one substrate.

55. (Amended) The method according to claim 52, wherein said positioning said at least one semiconductor substrate further comprises:

positioning said at least one semiconductor substrate substantially vertically.

56. (Amended) The method according to claim 55, wherein said introducing said flowable material comprises:

filling said at least one cavity until [a] said single flow front of said flowable material contacts said at least one vent.

57. (Amended) The method according to claim 56, wherein said filling said at least one cavity with said flowable material comprises:

at least partially encapsulating said at least one semiconductor substrate.

60. (Amended) The method according to claim 51, wherein said introducing said flowable material onto said at least one surface of said at least one substrate in said upward, non-horizontal direction comprises:

substantially preventing voids in said flowable material.

61. (Amended) The method according to claim 51, wherein said providing said at least one semiconductor substrate comprises:

providing an assembly including said at least one semiconductor substrate.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Vernon M. Williams

Serial No.: 09/652,503

Filed: August 31, 2000

For: TRANSFER MOLDING AND UNDERFILLING METHOD AND APPARATUS

Examiner: W. Brewster

Group Art Unit: 2823

Attorney Docket No.: 4303US (99-0584)

Notice of Allowance Mailed:

July 11, 2002

NOTICE OF EXPRESS MAILING

Express Mail Mailing Label Number: EV209824478US

Date of Deposit with USPS: October 9, 2002

Person making Deposit: Orlena Howell

COMMENTS ON STATEMENT OF REASONS FOR ALLOWANCE

Box Issue Fee
Commissioner for Patents
Washington, D.C. 20231

Sir:

The Examiner's statement of reasons for allowance is appropriate insofar as it pertains to the independent claims, particularly as the Examiner notes that the prior art of record neither anticipates nor renders obvious the claimed invention as a whole, which Applicant interprets as meaning that the claims including the limitation set forth in the comments are to be read as a whole. However, Applicants note the presence of dependent claims 2-11, 13, 16-25, 52-61, 63 and 66-75, which dependent claims recite additional patentable elements and features untaught

and unsuggested by the art of record. Accordingly, the scope of the claims as allowed, including the independent claims, must be determined from their literal language and all equivalents thereof.

Respectfully submitted,

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